

IN THE CLAIMS:

- 1 1. (Previously presented) A router controlling congestion on links attached to the
2 router, said router comprising:
3 a plurality of ports;
4 a first port of said plurality of ports for receiving a data packet;
5 a second port of said plurality of ports for transmitting said data packet;
6 a receiver to receive an incoming loss report message on said second port;
7 a first processor to determine loss of packets on selected ports of said plurality of
8 ports;
9 a second processor to calculate, in response to said incoming loss report message
10 and said loss of packets, a loss rate statistic; and
11 a transmitter to transmit an outgoing loss report message through said first port,
12 said outgoing loss report message containing a field having said loss rate statistic written
13 therein.
- 1 2. (Cancelled)
- 1 3. (Cancelled)
- 1 4. (Previously presented) The router as in claim 1 wherein said loss rate statistic is a
2 largest loss rate in a set of loss rates determined for said selected ports of said plurality of
3 ports.
- 1 5. (Previously presented) A router controlling congestion on links attached to the
2 router, said router comprising:

3 a plurality of ports;
4 a first port of said plurality of ports for receiving a data packet;
5 a second port of said plurality of ports for transmitting said data packet;
6 a receiver to receive an incoming loss report message on said second port;
7 a first processor to determine loss of packets on selected ports of said plurality of
8 ports;
9 a second processor to calculate, in response to said incoming loss report message
10 and said loss of packets, a loss rate statistic; and
11 a transmitter to transmit an outgoing loss report message through said first port,
12 said outgoing loss report message containing a field having said loss rate statistic written
13 therein,
14 wherein said loss rate statistic is a time averaged loss rate.

1 6. (Previously presented) The router of claim 1, further comprising:
2 a linecard supporting at least one of said plurality of ports, said linecard having
3 said first processor and a memory mounted thereon, said first processor computing said
4 loss of packets.

1 7. (Previously presented) The router of claim 1, further comprising: said outgoing
2 loss report message is carried in a NAK packet.

1 8. (Previously presented) The router of claim 1, further comprising: said outgoing
2 loss report message is transmitted by said router in response to the router receiving a loss
3 report message from a downstream router.

1 9. (Previously presented) The router of claim 1, further comprising: said outgoing
2 loss report message is transmitted by said router in response to the router receiving a loss
3 report message from a downstream receiver station.

1 10. (Previously presented) The router of claim 1, further comprising: said outgoing
2 loss report message is periodically transmitted by said router.

1 11. (Previously presented) The router of claim 1, further comprising:
2 a central processor (CPU) forwarding engine, said CPU forwarding engine determining
3 which port said outgoing loss report message is to be transmitted.

1 12. (Previously presented) The router as in claim 1, further comprising:
2 a central processor (CPU) control engine, said CPU control engine generating said outgoing loss report message.
3

1 13. (Previously presented) A method for operating a router, said method comprising:
2 receiving a multicast group data packet at a first port;
3 transmitting a replica of said multicast group data packet from a second port;
4 receiving an incoming loss report message on said second port;
5 computing a loss of packets on selected ports of said router;
6 calculating, in response to said incoming loss report message and said loss of
7 packets, a loss rate statistic; and
8 transmitting an outgoing loss report message through said first port, said outgoing
9 loss report message containing said loss rate statistic in a field of said outgoing loss re-
10 port message.

1 14. (Previously presented) The method of claim 13, further comprising:
2 choosing said loss rate statistic as a largest packet loss rate in a set of loss rates computed
3 for said selected ports of said router.

1 15. (Previously presented) A method for operating a router, said method compris-
2 ing:
3 receiving a multicast group data packet at a first port;
4 transmitting a replica of said multicast group data packet from a second port;
5 receiving an incoming loss report message on said second port;
6 computing a loss of packets on selected ports of said router;
7 calculating, in response to said incoming loss report message and said loss of
8 packets, a loss rate statistic;
9 transmitting an outgoing loss report message through said first port, said outgoing
10 loss report message containing said loss rate statistic in a field of said outgoing loss re-
11 port message; and
12 choosing said loss rate statistic as a time averaged packet loss rate as determined
13 by said router.

1 16. (Original) The method of claim 13, further comprising:
2 selecting said selected ports as members of a multicast group distribution tree.

1 17. (Previously presented) The method of claim 13, further comprising:
2 determining a loss rate statistic which has not expired for at least one port of said
3 router, where said at least one port includes all ports of a multicast group distribution tree
4 of said multicast group; and
5 writing said loss rate statistic into said outgoing loss report message before trans-
6 mitting said outgoing loss report message.

1 18. (Previously presented) The method of claim 13, further comprising: transmitting
2 said outgoing loss report message as a NAK packet.

1 19. (Previously presented) The method of claim 13, further comprising: transmitting
2 said outgoing loss report message in response to receiving said incoming loss report mes-
3 sage.

1 20. (Previously presented) The method of claim 13, further comprising: transmitting
2 said outgoing loss report message periodically.

1 21. (Previously presented) The method of claim 13, further comprising: transmitting
2 said outgoing loss report message as a unicast message to a next upstream router capable
3 of responding to said outgoing loss report message.

1 22. (Original) The method of claim 13 further comprising: transmitting said outgo-
2 ing loss report message as a multicast message.

1 23. (Previously presented) A router, comprising:
2 means for receiving a multicast group data packet at a first port;
3 means for transmitting a replica of said multicast group data packet from a second
4 port;
5 means for receiving an incoming loss report message on said second port;
6 means for computing a loss of packets on selected ports of said router;
7 means for calculating, in response to said incoming loss report message and said
8 loss of packets, a loss rate statistic; and

9 means for transmitting an outgoing loss report message through said first port,
10 said outgoing loss report message containing said loss rate statistic in a field of said out-
11 going loss report message.

1 24. (Original) A computer readable media having instructions written thereon for
2 practicing the method of claim 13.

1 25. (Previously presented) Electromagnetic signals carried on a computer network,
2 said electromagnetic signals carrying instructions for practicing the method of claim 13.

1 26. (Previously presented) The router as in claim 1, wherein said outgoing loss report
2 message is received at a source station of a multicast distribution tree, said source station
3 controlling a transmission rate of data packets transmitted in said multicast distribution
4 tree based on the value of said loss rate statistic stored in said outgoing loss report mes-
5 sage.

1 27. (Previously presented) The method as in claim 13, further comprising:
2 receiving said outgoing loss report message at a source station of a multicast dis-
3 tribution tree; and
4 controlling, in response to receiving said outgoing loss report message, a trans-
5 mission rate of data packets transmitted by said source station in said multicast distribu-
6 tion tree based on the value of said loss rate statistic stored in said outgoing loss report
7 message.

1 28. (Previously presented) The router as in claim 1, wherein said outgoing loss report
2 message is not transmitted by said transmitter if an absolute value of a fractional change

3 of said loss rate statistic, as compared with a previous loss rate statistic, is less than or
4 equal to a predetermined limit value.

1 29. (Previously presented) The method as in claim 13, further comprising:
2 calculating an absolute value of a fractional change of said loss rate statistic as
3 compared with a previous loss rate statistic; and
4 preventing, in response to said calculated absolute value being less than or equal
5 to a predetermined limit value, transmission of said outgoing loss report message.

1 30. (Previously presented) The router as in claim 1, wherein said outgoing loss report
2 message stores a lifetime associated with said loss rate statistic, said lifetime indicating a
3 duration of time for which said loss rate statistic is valid.

1 31. (Previously presented) The method of claim 13, further comprising:
2 associating with said loss rate statistic a lifetime for aging said loss rate statistic;
3 determining whether said loss rate statistic is valid based on the value of said life-
4 time associated with said loss rate statistic; and
5 writing, in response to determining that said loss rate statistic is valid, said loss
6 rate statistic into said outgoing loss report message before transmitting said outgoing loss
7 report message.

1 32. (Previously presented) A router controlling congestion on links attached to the
2 router, said router comprising:
3 a plurality of ports;
4 a first port of said plurality of ports for receiving a data packet;
5 a second port of said plurality of ports for transmitting said data packet;

6 a receiver configured to receive an incoming loss report message on said second
7 port;

8 a processor configured to determine loss of packets on selected ports of said plu-
9 rality of ports, said processor being further configured to calculate, in response to said
10 incoming loss report message and said loss of packets, a loss rate statistic; and

11 a transmitter configured to transmit an outgoing loss report message through said
12 first port, said outgoing loss report message containing a field having said loss rate statis-
13 tic written therein.

1 33. (Previously presented) A router controlling congestion on links attached to the
2 router, said router comprising:

3 a plurality of ports;

4 a first port of said plurality of ports for receiving a data packet;

5 a second port of said plurality of ports for transmitting said data packet in a down-
6 stream direction;

7 a processor configured to determine loss of packets on a port of said plurality of
8 ports and, in response to said loss of packets, to calculate a loss rate statistic; and

9 a transmitter configured to transmit an outgoing loss report message through said
10 first port in an upstream direction, said outgoing loss report message containing a field
11 having said loss rate statistic written therein.

1 34. (Previously presented) The router as in claim 33, further comprising:

2 a receiver to receive a loss report message on said second port, said loss report
3 traveling in said upstream direction; and

4 said processor to calculate said loss rate statistic in response to said loss of pack-
5 ets and in response to said loss report.

1 35. (Previously presented) The router as in claim 33, further comprising:
2 said loss rate statistic is a largest loss rate in a set of loss rates determined for said
3 selected ports of said plurality of ports.

1 36. (Previously presented) The router as in claim 33, further comprising:
2 said loss rate statistic is a time averaged loss rate.

1 37. (Previously presented) The router of claim 33, further comprising:
2 a linecard supporting at least one of said plurality of ports, said linecard having a
3 linecard processor and a memory mounted thereon, said linecard processor computing
4 said loss of packets.

1 38. (Previously presented) The router of claim 33, further comprising:
2 a central processor (CPU) forwarding engine, said CPU forwarding engine deter-
3 mining which port said outgoing loss report message is to be transmitted.

1 39. (Previously presented) The router as in claim 33, further comprising:
2 a central processor (CPU) control engine, said CPU control engine generating said
3 outgoing loss report message.

1 40. (Previously presented) The router of claim 33, further comprising:
2 said outgoing loss report message is carried in a NAK packet.

41. (Previously presented) The router of claim 33, further comprising:
1 said outgoing loss report message is transmitted by said router in response to the
2 router receiving a loss report message from a downstream router.
42. (Previously presented) The router of claim 33, further comprising:
2 said outgoing loss report message is periodically transmitted by said router.
43. (Previously presented) The router as in claim 33, further comprising:
2 said outgoing loss report message is received at a source station of a multicast
3 distribution tree, said source station controlling a transmission rate of data packets trans-
4 mitted in said multicast distribution tree based on the value of said loss rate statistic
5 stored in said outgoing loss report message.
44. (Previously presented) The router as in claim 33, further comprising:
2 means for receiving said outgoing loss report message at a source station of a
3 multicast distribution tree; and
4 means for controlling, in response to receiving said outgoing loss report message,
5 a transmission rate of data packets transmitted by said source station in said multicast dis-
6 tribution tree based on the value of said loss rate statistic stored in said outgoing loss re-
7 port message.
45. (Previously presented) The router as in claim 33, further comprising:
2 said outgoing loss report message is not transmitted by said transmitter if an abso-
3 lute value of a fractional change of said loss rate statistic, as compared with a previous
4 loss rate statistic, is less than or equal to a predetermined limit value.

- 1 46. (Previously presented) The router as in claim 33, further comprising:
2 said outgoing loss report message stores a lifetime associated with said loss rate
3 statistic, said lifetime indicating a duration of time for which said loss rate statistic is
4 valid.
- 1 47. (Previously presented) A method for operating a router, comprising:
2 receiving a data packet traveling in a downstream direction at a first port;
3 transmitting a replica of said data packet from a second port in said downstream
4 direction;
5 computing a loss of packets on selected ports of said router;
6 calculating, in response to said loss of packets, a loss rate statistic; and
7 transmitting an outgoing loss report message through said first port in an upstream
8 direction, said outgoing loss report message containing said loss rate statistic in a field of
9 said outgoing loss report message.
- 1 48. (Previously presented) The router as in claim 47, further comprising:
2 receiving a loss report message on said second port, said loss report traveling in
3 said upstream direction; and
4 calculating said loss rate statistic in response to said loss of packets and in re-
5 sponse to said loss report.
- 1 49. (Previously presented) The method of claim 47, further comprising:
2 calculating said loss rate statistic as a largest loss rate in a set of loss rates deter-
3 mined for said selected ports of said plurality of ports.

- 1 50. (Previously presented) The method of claim 47, further comprising:
2 calculating said loss rate statistic as a time averaged loss rate.
- 1 51. (Previously presented) The method of claim 47, further comprising:
2 computing said loss of packets by a processor mounted on a linecard, said line-
3 card supporting at least one of said plurality of ports, said linecard having said linecard
4 processor and a memory mounted thereon.
- 1 52. (Previously presented) The method of claim 47, further comprising:
2 determining which port said outgoing loss report message is to be transmitted by a
3 central processor (CPU) forwarding engine.
- 1 53. (Previously presented) The method as in claim 47, further comprising:
2 generating said outgoing loss report message by a central processor (CPU) control
3 engine.
- 1 54. (Previously presented) The method of claim 47, further comprising:
2 carrying said outgoing loss report message in a NAK packet.
- 1 55. (Previously presented) The method of claim 47, further comprising:
2 transmitting said outgoing loss report message by said router in response to the
3 router receiving a loss report message from a downstream router.
- 1 56. (Previously presented) The method of claim 47, further comprising:
2 transmitting said outgoing loss report message periodically by said router.

1 57. (Previously presented) The method as in claim 47, further comprising:
2 transmitting said outgoing loss report message upstream so that it can be received
3 at a source station of a multicast distribution tree, said source station controlling a trans-
4 mission rate of data packets transmitted in said multicast distribution tree based on the
5 value of said loss rate statistic stored in said outgoing loss report message.

1 58. (Previously presented) The method as in claim 47, further comprising:
2 receiving said outgoing loss report message at a source station of a multicast dis-
3 tribution tree; and
4 controlling, in response to receiving said outgoing loss report message, a trans-
5 mission rate of data packets transmitted by said source station in said multicast distribu-
6 tion tree based on the value of said loss rate statistic stored in said outgoing loss report
7 message.

1 59. (Previously presented) The method as in claim 47, further comprising:
2 calculating an absolute value of a fractional change of said loss rate statistic as
3 compared with a previous loss rate statistic; and
4 preventing, in response to said calculated absolute value being less than or equal
5 to a predetermined limit value, transmission of said outgoing loss report message.

1 60. (Previously presented) The method of claim 47, further comprising:
2 associating with said loss rate statistic a lifetime for aging said loss rate statistic;
3 determining whether said loss rate statistic is valid based on the value of said life-
4 time associated with said loss rate statistic; and
5 writing, in response to determining that said loss rate statistic is valid, said loss
6 rate statistic into said outgoing loss report message before transmitting said outgoing loss
7 report message.

1 61. (Previously presented) A router, comprising:
2 means for receiving a data packet traveling in a downstream direction at a first
3 port;
4 means for transmitting a replica of said data packet from a second port in said
5 downstream direction;
6 means for computing a loss of packets on selected ports of said router;
7 means for calculating, in response to said loss of packets, a loss rate statistic; and
8 means for transmitting an outgoing loss report message through said first port in
9 an upstream direction, said outgoing loss report message containing said loss rate statistic
10 in a field of said outgoing loss report message.

1 62. (Previously presented) The router as in claim 61, further comprising:
2 means for receiving a loss report message on said second port, said loss report
3 traveling in said upstream direction; and
4 means for calculating said loss rate statistic in response to said loss of packets and
5 in response to said loss report.

1 63. (Previously presented) The router of claim 61, further comprising:
2 means for calculating said loss rate statistic as a largest loss rate in a set of loss
3 rates determined for said selected ports of said plurality of ports.

1 64. (Previously presented) The router of claim 61, further comprising:
2 means for calculating said loss rate statistic as a time averaged loss rate.

1 65. (Previously presented) The router of claim 61, further comprising:
2 means for computing said loss of packets by a processor mounted on a linecard,
3 said linecard supporting at least one of said plurality of ports, said linecard having said
4 linecard processor and a memory mounted thereon.

1 66. (Previously presented) The router of claim 61, further comprising:
2 means for determining which port said outgoing loss report message is to be
3 transmitted by a central processor (CPU) forwarding engine.

1 67. (Previously presented) The router as in claim 61, further comprising:
2 means for generating said outgoing loss report message by a central processor
3 (CPU) control engine.

1 68. (Previously presented) The router of claim 61, further comprising:
2 means for carrying said outgoing loss report message in a NAK packet.

1 69. (Previously presented) The router of claim 61, further comprising:
2 means for transmitting said outgoing loss report message by said router in re-
3 sponse to the router receiving a loss report message from a downstream router.

1 70. (Previously presented) The router of claim 61, further comprising:
2 means for transmitting said outgoing loss report message periodically by said
3 router.

1 71. (Previously presented) The router as in claim 61, further comprising:
2 means for transmitting said outgoing loss report message upstream so that it can
3 be received at a source station of a multicast distribution tree, said source station control-
4 ling a transmission rate of data packets transmitted in said multicast distribution tree
5 based on the value of said loss rate statistic stored in said outgoing loss report message.

1 72. (Previously presented) The router as in claim 61, further comprising:
2 means for receiving said outgoing loss report message at a source station of a
3 multicast distribution tree; and
4 means for controlling, in response to receiving said outgoing loss report message,
5 a transmission rate of data packets transmitted by said source station in said multicast dis-
6 tribution tree based on the value of said loss rate statistic stored in said outgoing loss re-
7 port message.

1 73. (Previously presented) The router as in claim 61, further comprising:
2 means for calculating an absolute value of a fractional change of said loss rate sta-
3 tistic as compared with a previous loss rate statistic; and
4 means for preventing, in response to said calculated absolute value being less than
5 or equal to a predetermined limit value, transmission of said outgoing loss report mes-
6 sage.

1 74. (Previously presented) The router of claim 61, further comprising:
2 means for associating with said loss rate statistic a lifetime for aging said loss rate
3 statistic;
4 means for determining whether said loss rate statistic is valid based on the value
5 of said lifetime associated with said loss rate statistic; and

6 means for writing, in response to determining that said loss rate statistic is valid,
7 said loss rate statistic into said outgoing loss report message before transmitting said out-
8 going loss report message.

1 75. (Previously presented) A computer readable media, comprising:
2 said computer readable media having instructions written thereon for execution on
3 a processor for the practice of a method of operating a router, the method having the steps
4 of,
5 receiving a multicast group data packet at a first port;
6 transmitting a replica of said multicast group data packet from a second port;
7 receiving an incoming loss report message on said second port;
8 computing a loss of packets on selected ports of said router;
9 calculating, in response to said incoming loss report message and said loss of
10 packets, a loss rate statistic; and
11 transmitting an outgoing loss report message through said first port, said outgoing
12 loss report message containing said loss rate statistic in a field of said outgoing loss re-
13 port message.

1 76. (Previously presented) Electromagnetic signals propagating on a computer net-
2 work, comprising:
3 said electromagnetic signals carrying instructions for execution on a processor for
4 the practice of a method of operating a router, the method having the steps of,
5 receiving a multicast group data packet at a first port;
6 transmitting a replica of said multicast group data packet from a second port;
7 receiving an incoming loss report message on said second port;
8 computing a loss of packets on selected ports of said router;
9 calculating, in response to said incoming loss report message and said loss of
10 packets, a loss rate statistic; and

11 transmitting an outgoing loss report message through said first port, said outgoing
12 loss report message containing said loss rate statistic in a field of said outgoing loss re-
13 port message.

1 77. (Previously presented) A computer readable media, comprising:
2 said computer readable media having instructions written thereon for execution on
3 a processor for the practice of a method of operating a router, the method having the steps
4 of,
5 receiving a data packet traveling in a downstream direction at a first port;
6 transmitting a replica of said data packet from a second port in said downstream
7 direction;
8 computing a loss of packets on selected ports of said router;
9 calculating, in response to said loss of packets, a loss rate statistic; and
10 transmitting an outgoing loss report message through said first port in an upstream
11 direction, said outgoing loss report message containing said loss rate statistic in a field of
12 said outgoing loss report message.

1 78. (Previously presented) Electromagnetic signals propagating on a computer net-
2 work, comprising:
3 said electromagnetic signals carrying instructions for execution on a processor for
4 the practice of a method of operating a router, the method having the steps of,
5 receiving a data packet traveling in a downstream direction at a first port;
6 transmitting a replica of said data packet from a second port in said downstream
7 direction;
8 computing a loss of packets on selected ports of said router;
9 calculating, in response to said loss of packets, a loss rate statistic; and

10 transmitting an outgoing loss report message through said first port in an upstream
11 direction, said outgoing loss report message containing said loss rate statistic in a field of
12 said outgoing loss report message.